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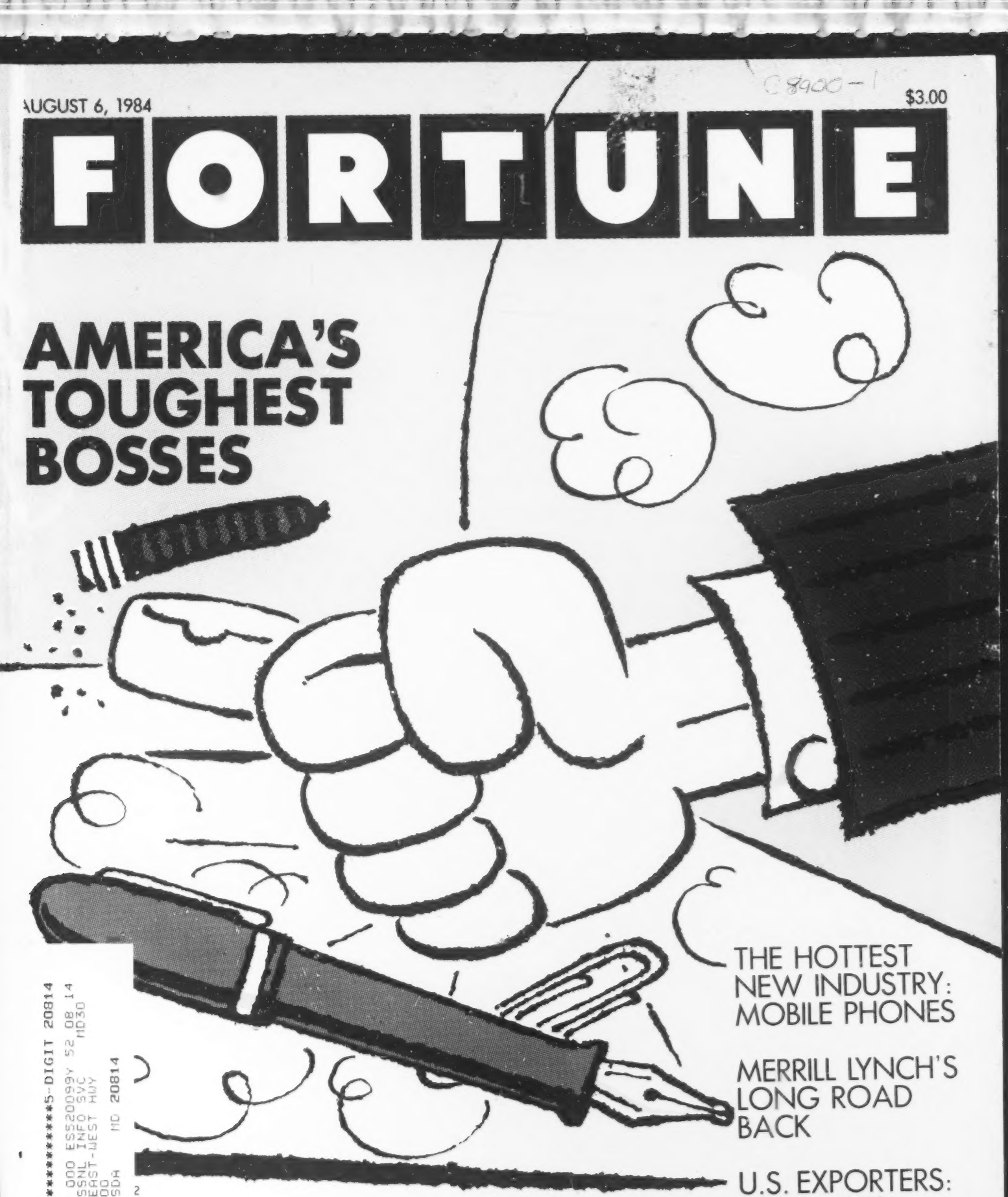
AMERICA'S TOUGHEST BOSSES



THE HOTTEST NEW INDUSTRY: MOBILE PHONES

MERRILL LYNCH'S LONG ROAD BACK

U.S. EXPORTERS: FORTUNE'S TOP 50

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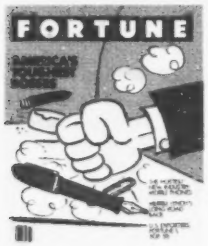
AUGUST 6, 1984 VOL. 110, NO. 3

FORTUNE



The top ten desk pounders in U.S. business, symbolized on the cover by Gary Hallgren, are wildly diverse—and diversely wild. For who they are, see page 18.

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LETTERS TO FORTUNE

where rapid acidification of lakes has occurred, have never been logged or subjected to other land-use modifications.

The statement that acid rain has been studied for only six years illustrates Brown's superficial knowledge of the issue. Our National Academy report referenced studies from the 19th century illustrating that acidic precipitation was occurring in the United Kingdom. A number of studies were conducted in the 1950s and 1960s in both Europe and North America. Major conclusions reached from these early studies differed little from those reached after later, more comprehensive work. The studies had simply not caught the fancy of the popular press and were not widely publicized.

Perhaps the most unfair insinuation in Brown's article is that all ecologists are a pack of ecofreaks who will distort any evidence, bankrupt any industry, or perform any sort of social disruption to protect the environment. On the contrary, most ecologists are very conservative people whose careers depend upon a productive society. A high proportion of them currently have jobs and research funds that depend directly on acid rain research. Who among us would not like to be the one to prove that all others have mistakenly assigned responsibility for environmental damage to acid rain? For he who did would surely win a Nobel Prize.

D. W. SCHINDLER
Chairman
Committee on the Atmosphere and the Biosphere
U.S. National Academy of Sciences
Winnipeg, Manitoba

William M. Brown's article is filled with factual errors, half-truths, and irrelevant speculation. He says, "The rain has been studied only for about six years." I and many others have been studying the chemistry of rain and snow continuously for the last 20 years in North America.

He writes, "In fact, little of the acidity in lakes is rained onto them directly." This statement just isn't correct for many lakes. For example, Honnedaga Lake, a large, recently acidified lake in the Adirondack Mountains of New York, receives more than 70% of its annual hydrogen ion input directly from precipitation falling on the lake.

Brown says, "... the pollutants in the rain are only a minor contribution to the high-level acidity found in some Eastern lakes and streams." This is not true. Recently acidified lakes have been acidified by sulfuric and nitric acids. Sulfate is the dominant anion in such lakes, whereas in similarly sensitive areas not receiving acid precipitation, such as the Sierra Nevada Mountains, bicarbonate is the dominant anion.

Brown says, "... this acidity, which is indeed hostile to the existence of game fish and other aquatic creatures, is mostly natural rather than industrial in origin." Brown refers to an article by Krug and Frink recently published in *Science* that promotes the importance of natural acidity. This work has been criticized by numerous scientists from around the world, and their rebuttals will appear shortly in the same pages of *Science*.

Brown's speculation is simply unsupported by scientific data. Red herrings such as those spawned by him only add confusion to an already complex environmental issue.

GENE E. LIKENS
Director, Institute of Ecosystem Studies
The New York Botanical Garden
Millbrook, New York

William M. Brown responds: My article was intended to show that there are at least two scientific views about acid rain, a fact that is hard to glean from the press or television. Both Likens and Schindler, judging from their letters, seem to wish that the opposition to their views would vanish. In addition, both gentlemen chose to include a personal attack against me. Likens accuses me of hatching "red herrings" and engaging in unwarranted speculation when in fact I was portraying hypotheses that have considerable support from many respected scientists. Schindler concluded that I was insinuating that all ecologists are unconscionable "ecofreaks." My reply is, "Utter nonsense."

Now let us turn to substance. Likens and Schindler are both correct in asserting that studies from the distant past have been used in the search for evidence about acid precipitation and its effect.

Likens mentions Honnedaga Lake as one of "many" lakes that receive most of their acidity by direct precipitation. The essential issue here is the relative size of lakes and their watersheds. While there are occasional exceptions, it is a simple fact that nearly all U.S. lakes have watersheds that are much larger than the lakes they feed and that the bulk of the water entering those lakes has percolated through the soils of those watersheds.

Whether "recently" acidified lakes have been acidified by sulfuric and nitric acids, as Likens asserts, is a major scientific issue. The contrary position is that the relatively small amounts of those acids in rainfall will be strongly affected by the chemistry of the soils in the watershed. In that way the soils remain the major determinant of the amount and type of acids that enter aquatic systems.

The Science *article by Krug and Frink, which emphasizes natural sources of acidity, will undoubtedly be criticized by many scientists. It has been strongly supported by many other scientists. Only more time and research can finally resolve that debate.*

Lakes and forests are enormously complex systems whose biology and chemistry may be affected by highly variable inputs in both the short and long term. Consequently, there probably are no easy answers to the major scientific issues. Because much of the debate about the impact of acid rain upon these systems is emotional and is conducted in the public arena, we must expect that popular images and solutions will tend to obscure more rational ones.

Donating Organs

Re "The Life-and-Death Question of an Organ Market" (June 11): As a dialysis patient awaiting a transplant, I think a more equitable solution would be to legalize the recovery of organs from any brain-dead accident victim without the need for consent. This would help prevent an auction market. It would also help eliminate the backlog of patients awaiting transplant, improve their quality of life, and result in big savings for Medicare.

JAMES W. GIBSON
Kettering, Ohio

Our son was the victim of a motorcycle accident in which the back of his helmet severed his spinal cord. He was being maintained on life support systems when we flew in and asked to donate his organs. We donated, but it appears from the thank-you notes that only his eyes and kidneys were utilized. He should have had the privilege of helping more people. In this day of computerized communications, the availability of organs needs to be better broadcast. Your article talked about buying and selling. Our son was giving.

MARY P. JOHNSEN
JOHN L. JOHNSEN
Portland, Oregon

The Mail-Order Business

"Glut and Gluttony in the Mail-Order Business" (July 9) really hit home. After a frustrating three-year campaign, I think I have finally been successful in ridding my mailbox of the pestilence of mail-order catalogues. At one point I was getting them at the rate of 100 per month. Twice the door of my mailbox was broken and had to be repaired at considerable expense. However, if one is persistent, obnoxious, and angry enough about the junk that daily gets squashed into his mailbox, he can get relief. It's heaven, believe me.

GEORGE R. PERRIN
New York City

Corrections

The Notes to the FORTUNE *500 directory (April 30) stated that for the purpose of determining primary earnings per share, common stock equivalents include "convertible securities whose cash yield is less than two-thirds of the prime rate at the time the securities were issued." That is correct if the securities were issued before February 28, 1982. For convertible securities issued after that date, the test is whether at issuance the cash yield was less than two-thirds of the average Aa corporate bond yield.*

News/Trends (July 9) stated that the highest price attained by Merrill Lynch common stock was $110 per share in 1982 and that the recent low was $22. Adjusted for a two-for-one stock split in 1983, as it should have been, the stock's high, which was in mid-1983, was $56.50. ◼

THE 50 LEADING EXPORTERS

THE FORTUNE DIRECTORY OF THE LARGEST U.S. INDUSTRIAL EXPORTERS

A staggeringly strong dollar, economic doldrums in Europe, and financial disasters in Latin America combined to produce a slow year for American companies selling their wares worldwide. General Motors drove off with the No. 1 position on the list.

MOST U.S. EXPORTERS had a pretty slow 1983. But not General Motors, which topped FORTUNE's annual ranking of the 50 largest industrial exporters for the second year in a row. The auto giant's foreign sales accelerated 39%, $1.8 billion, over 1982. That's more than the total dollar increase for all 50 companies put together—half of the 50 had lower exports last year than the year before, including ITT, Eastman Kodak, and Philip Morris. Even with GM pulling the export volume up to $60.3 billion, last year's total was only 2.6% higher than 1982, and was 4.3% *lower* than the 50's total foreign sales in 1981.

Small and medium-size companies had trade trouble too. Total U.S. merchandise exports, including farm products and military hardware, were down 4.7% to $213 billion. The trade deficit hit a record $69.4 billion. Nonetheless, U.S. Trade Representative William Brock says it was "remarkable" that exports did so well in the face of "some pretty tough odds."

The dollar remained the biggest handicap. Its third year of strength against other currencies kept U.S. goods relatively more costly in the international marketplace. A continuing economic slump has reduced sales of U.S. products in Europe, and too little cash and too much debt have all but stopped exports to Latin America.

Still, the auto companies surged stunningly. GM increased shipments of parts to assembly plants in Canada and Latin America. Fully assembled vehicles sold well in Saudi Arabia and Kuwait. After GM, Ford was the list's second-biggest gainer, moving up one notch to No. 3 on the power of a 26.8% increase. Chrysler jumped 15.7%.

Five of the list's seven aerospace companies headed skyward, led by Boeing's 24.2% rise. In spite of good sales of its new 757s—British Airways bought eight of them—Boeing was still over a billion dollars below its export total for 1981, the last year it led the 50. It remains the leader by far in exports as a percent of total sales.

The computer industry also did well, with gains for four of the list's six high-tech companies in spite of industrywide complaints about government export restrictions (see following story). IBM set the pace for the group with a 21.3% increase in sales abroad. Burroughs's exports dropped slightly, however, and Sperry's plummeted 32%, mainly because the strong dollar hurt business in Europe.

The biggest percentage losers for 1983 were Ingersoll-Rand and Caterpillar Tractor. Ingersoll's exports fell 37.3%, in part because the drop in oil prices hurt its sales of compressors and pumps in the Middle East. A slight recovery in Caterpillar Tractor's orders from industrialized countries could not match sales lost to cash-strapped nations. Besides, Japan's Komatsu has harvested some of Cat's business by underpricing it in many markets. Since Caterpillar is second only to Boeing in its dependence on sales abroad, the 36% reduction in exports contributed substantially to the company's record loss of $345 million.

Acquisition and divestiture changed the makeup of the list. Three of the six companies that dropped off—American Motors, Harris, and International Harvester—did so after selling off export businesses. Allied rejoined the 50 after a one-year disappearance thanks to its acquisition of Bendix, a large exporter of automotive and aircraft parts. International Minerals & Chemical also returned, largely because of higher sales of fertilizer and petroleum coke to Japan.

Since the list is compiled using only published numbers, Honeywell materialized at No. 32 after publicly reporting its figures for the first time. Motorola disappeared because it stopped issuing complete data. Motorola says its exports totaled $884 million last year. The company would have ranked No. 20 had it published the figure.

Export results for the first quarter of 1984 show signs of a modest upturn for manufactured goods. But that's not very encouraging since imports were increasing even more rapidly. The Commerce Department projects a trade deficit of $130 billion this year, more than 3½ times the deficit in 1979, the first year of the FORTUNE directory.

Trade Representative Brock believes matters won't improve until Congress addresses that other worrisome shortfall, the nearly $200-billion federal budget deficit. The resulting high interest rates, he says, keep the dollar's value high and make credit too costly for potential foreign customers.

But Brock emphasizes the positive, saying that exporters have used the period of high interest rates in the U.S. and recession in other parts of the world to reduce expenses, especially labor costs. "We're adjusting despite the value of the dollar," he says. "We'll be better competitors because of this, but it sure has been agonizing." The export agony continues.

— David Kirkpatrick

RANK 1983	RANK 1982	COMPANY	PRODUCTS	EXPORTS $000	FORTUNE 500 SALES $000	FORTUNE 500 SALES RANK	EXPORTS AS PERCENT OF SALES PERCENT	EXPORTS AS PERCENT OF SALES RANK
1	1	**General Motors** (Detroit)	Motor vehicles & parts, locomotives, diesel engines	6,493,400	74,581,600	2	8.71	37
2	3	**Boeing** (Seattle)	Commercial aircraft	4,819,000	11,129,000	27	43.30	1
3	4	**Ford Motor** (Dearborn, Mich.)	Motor vehicles & parts	4,732,000	44,454,600	4	10.64	30
4	2	**General Electric** (Fairfield, Conn.)	Aircraft engines, generating equipment, locomotives	4,229,000	26,797,000	10	15.78	17
5	7	**United Technologies** (Hartford)	Aircraft engines, helicopters, air-conditioning equipment	2,383,411	14,669,265	18	16.25	16
6	6	**E.I. du Pont de Nemours** (Wilmington, Del.)	Chemicals, fibers, polymer & petroleum products, coal	2,303,000	35,378,000	7	6.51	42
7	9	**International Business Machines** (Armonk, N.Y.)	Information-handling systems, equipment & parts	2,275,000	40,180,000	5	5.66	44
8	8	**McDonnell Douglas** (St. Louis)	Aircraft, missiles, space systems	2,104,700	8,111,000	42	25.95	4
9	11	**Chrysler** (Highland Park, Mich.)	Motor vehicles & parts	2,078,600	13,240,399	21	15.70	18
10	10	**Eastman Kodak** (Rochester, N.Y.)	Photographic equipment & supplies	1,766,000	10,170,000	30	17.36	13
11	5	**Caterpillar Tractor** (Peoria, Ill.)	Earthmoving & construction equipment, engines, turbines	1,584,000	5,424,000	64	29.20	2
12	12	**Westinghouse Electric** (Pittsburgh)	Generating equipment, defense systems	1,389,223	9,532,600	34	14.57	20
13	15	**Hewlett-Packard** (Palo Alto, Calif.)	Computers, electronic equipment	1,105,000	4,710,000	75	23.46	6
14	14	**Philip Morris** (New York)	Tobacco products, soft drink ingredients, beer	1,084,000	9,465,600	35	11.45	28
15	16	**Signal Companies** (La Jolla, Calif.)	Engines, chemicals, audio-video systems	1,025,000	6,151,000	54	16.66	15
16	23	**Exxon** (New York)	Petroleum, chemicals	994,000	88,561,134	1	1.12	49
17	17	**Union Carbide** (Danbury, Conn.)	Chemicals, industrial & high-technology products	926,000	9,001,100	37	10.29	31
18	22	**General Dynamics** (St. Louis)	Tanks, aircraft, missiles, gun systems	910,900	7,146,300	46	12.75	27
19	20	**Archer Daniels Midland** (Decatur, Ill.)	Soybean meal & oil, wheat, flour, corn, corn byproducts	901,000	4,291,957	83	20.99	8
20	21	**Monsanto** (St. Louis)	Herbicides, chemicals, polymer products, fibers, silicon	879,000	6,299,000	52	13.95	23
21	18	**Weyerhaeuser** (Tacoma, Wash.)	Logs, pulp, paperboard, newsprint, lumber	870,000	4,882,629	70	17.82	12
22	25	**Northrop** (Los Angeles)	Aircraft, electronic equipment, related support services	827,700	3,260,600	123	25.38	5
23	24	**Dow Chemical** (Midland, Mich.)	Chemicals, plastics, magnesium metal	824,000	10,951,000	28	7.52	41
24	29	**Digital Equipment** (Maynard, Mass.)	Computers & related peripheral equipment	816,740	4,271,854	84	19.12	9
25	13	**Occidental Petroleum** (Los Angeles)	Agricultural chemical products, coal	803,000	19,115,700	14	4.20	46
26	19	**Raytheon** (Lexington, Mass.)	Electronic defense systems, aircraft	783,000	5,937,264	59	13.19	25
27	26	**ITT** (New York)	Logs, cellulose pulp	739,000	14,155,408	20	5.22	45
28	28	**Dresser Industries** (Dallas)	Compressors, pumps, oil-field & construction equipment	643,300	3,473,400	112	18.52	10
29	•	**Allied** (Morris Township, N.J.)	Medical instruments, connectors, fibers, chemicals	637,000	10,351,000	29	6.15	43
30	32	**Lockheed** (Burbank, Calif.)	Aircraft	594,000	6,490,300	50	9.15	36
31	35	**Phillips Petroleum** (Bartlesville, Okla.)	Liquefied natural gas, chemicals, petrochemicals, plastics	591,000	15,249,000	16	3.88	47
32	•	**Honeywell** (Minneapolis)	Electronic components, control systems, computers	537,000	5,753,100	60	9.33	35
33	38	**Minnesota Mining & Manufacturing** (St. Paul)	Electronic, industrial, health & graphics products	530,000	7,039,000	47	7.53	40
34	42	**Emerson Electric** (St. Louis)	Electronic & electromechanical components	501,900	3,475,709	111	14.44	21
35	39	**Celanese** (New York)	Fibers, chemicals	490,000	3,261,000	122	15.02	19
36	30	**FMC** (Chicago)	Defense, petroleum & farm equipment	482,797	3,498,162	110	13.80	24
37	31	**Deere** (Moline, Ill.)	Farm & industrial equipment	447,000	3,967,934	92	11.27	29
38	37	**Aluminum Co. of America** (Pittsburgh)	Aluminum, alumina	441,300	5,263,400	65	8.38	38
39	43	**Textron** (Providence)	Helicopters, aerospace products, chainsaws, pens	422,000	2,979,800	134	14.16	22
40	41	**Mobil** (New York)	Petroleum, chemicals	421,000	54,607,000	3	0.77	50
41	44	**R.J. Reynolds Industries** (Winston-Salem, N.C.)	Tobacco products	417,000	11,957,000	23	3.49	48
42	45	**International Paper** (New York)	Pulp, paper, wood products	407,000	4,357,100	80	9.34	34
43	49	**Burroughs** (Detroit)	Data-processing & business equipment	402,500	4,296,500	82	9.37	33
44	34	**Sperry** (New York)	Computer systems, electronics, farm equipment	401,300	5,076,000	66	7.91	39
45	•	**Int'l Minerals & Chemical** (Northbrook, Ill.)	Potash, phosphates, industrial minerals	393,300	1,462,000	237	26.90	3
46	33	**Ingersoll-Rand** (Woodcliff Lake, N.J.)	Drills, compressors, pumps, bearings, tools	387,100	2,274,075	165	17.02	14
47	•	**Engelhard** (Edison, N.J.)	Specialty chemical & metallurgical products	386,300	2,099,337	174	18.40	11
48	46	**Kaiser Aluminum & Chemical** (Oakland, Calif.)	Aluminum products	367,600	2,857,600	140	12.86	26
49	•	**A.E. Staley Manufacturing** (Decatur, Ill.)	Animal feeds, starches, vegetable oils, corn sweeteners	361,000	1,679,420	207	21.50	7
50	•	**Borg-Warner** (Chicago)	Air-conditioning & energy equip., auto parts, chemicals	360,400	3,542,100	106	10.17	32
		TOTALS		**60,267,471**	**656,877,947**			

• Not on last year's list.

LOOKING AHEAD

MOBILE PHONES: HOT NEW INDUSTRY

Buyers are rushing to get cellular phones in their cars at $2,500 each. Experts say the price is sure to go down—and demand way up. ■ *by Colin Leinster*

THE HOTTEST new U.S. industry right now is cellular telephony—phones in cars. In early July cellular telephone systems were operating in eight major U.S. metropolitan areas, including New York, Los Angeles, Washington-Baltimore, and Chicago, and they are being switched on at the rate of one a week in other cities. By 1990 the handful of subscribers chatting away today on the expressways in those eight cities will have grown to nearly a million—even on the unlikely assumption that costs of subscribing will not have dropped from lofty introductory levels (see chart, page 111). But that scarcely measures the potential for a cellular explosion.

Cellular telephones will be available in most of the top 30 metropolitan areas in the U.S. by the end of the year. Another 60 markets should be hooked up in the ensuing decade. According to some estimates, cellular will be a $12-billion-a-year industry ten years from now—$4 billion in revenues from the calls that are made, $4 billion from sales of equipment to cellular telephone users, and $4 billion for antennas, computers, buildings, and other elements of the receiving and transmitting systems. Cellular looks as if it could be the biggest consumer item of its kind since citizens' band radio—though CB proved to lack staying power and was one of the great marketing disappointments of the 1970s.

Worldwide expansion of cellular telephone systems could increase the industry's girth manyfold. The Scandinavian countries and Japan have already hatched cellular systems, and their equipment manufacturers have leaped into the U.S. market.

The investor eyeing this nascent industry is hardly confined to companies that seek to supply the service, which range from telephone company subsidiaries—Nynex, Ameritech, and their kin—to MCI, the Washington Post Co., and Western Union. Investors can also choose from an international menu of early starters among equipment suppliers. Oki Advanced Communications, the New Jersey-based cellular subsidiary of Japan's big Oki Telecom Group, vies with Motorola for first place among makers of cellular equipment. Sweden's Ericsson recently scooped up a big contract for a Chicago system—an estimated $6 million. Other big players in the U.S. equipment market include AT&T, Tandy, and NEC.

RESEARCH ASSOCIATE *Lynn Fleary*

The stocks of some manufacturing companies involved in cellular "went berserk" two years ago, says John S. Bain, telecommunications analyst with Lehman Brothers Kuhn Loeb. Communications Systems Inc. of Dallas, which makes cellular equipment, saw its stock go from $14 to $40 a share; the price is now riding along at about $20 a share. Right now, Bain says, cellular "is a generally depressed market." The business takes huge investment, and the payoff will take time. Lots of things could go wrong, including the

PHOTOGRAPH BY DONNA FERRATO—VISIONS

Inaugurating
cellular telephone service in New York City, Mayor Ed Koch makes the first call, to Albany. The phone, in a car parked at City Hall, is owned by Nynex Mobile Communications, the New York system's operator.

threat that prices won't drop fast enough to make a phone in the car as irresistible as it sounds. Another grim possibility is that cellular might prove so popular that emerging systems would be temporarily swamped, driving potential users away.

Right now only well-heeled, must-have-one individuals and those who can write it off can afford the hefty tab of cellular service. Equipment and installation cost about $2,500; that buys the handset in the car, plus the transmitter-receiver—known as a transceiver—and an antenna. Costs of the service vary from city to city. In Chicago, Ameritech Mobile Communications charges $22 per month as a basic fee for access to the system and 22 cents to 38 cents a minute, depending on the time of day. Long-distance tolls, of course, are extra. In Washington, Bell Atlantic Mobile Systems charges $25 a month plus 27 cents to 45 cents a minute.

Pressure on mobile equipment manufacturers to cut prices will be extreme as the first rush of cost-be-damned buyers subsides. The pressure will increase this fall when Tandy Corp., an adroit mass marketer of home electronic equipment through its nationwide chain of Radio Shack stores, comes out with its first cellular phones.

John V. Roach, Tandy's chairman and chief executive, believes that goods other than automobiles become mass-market items only when they cost under $1,000 each. Tandy's first cellular products will cost "a couple of thousand," Roach says. But he adds, "If what I think is going to happen in

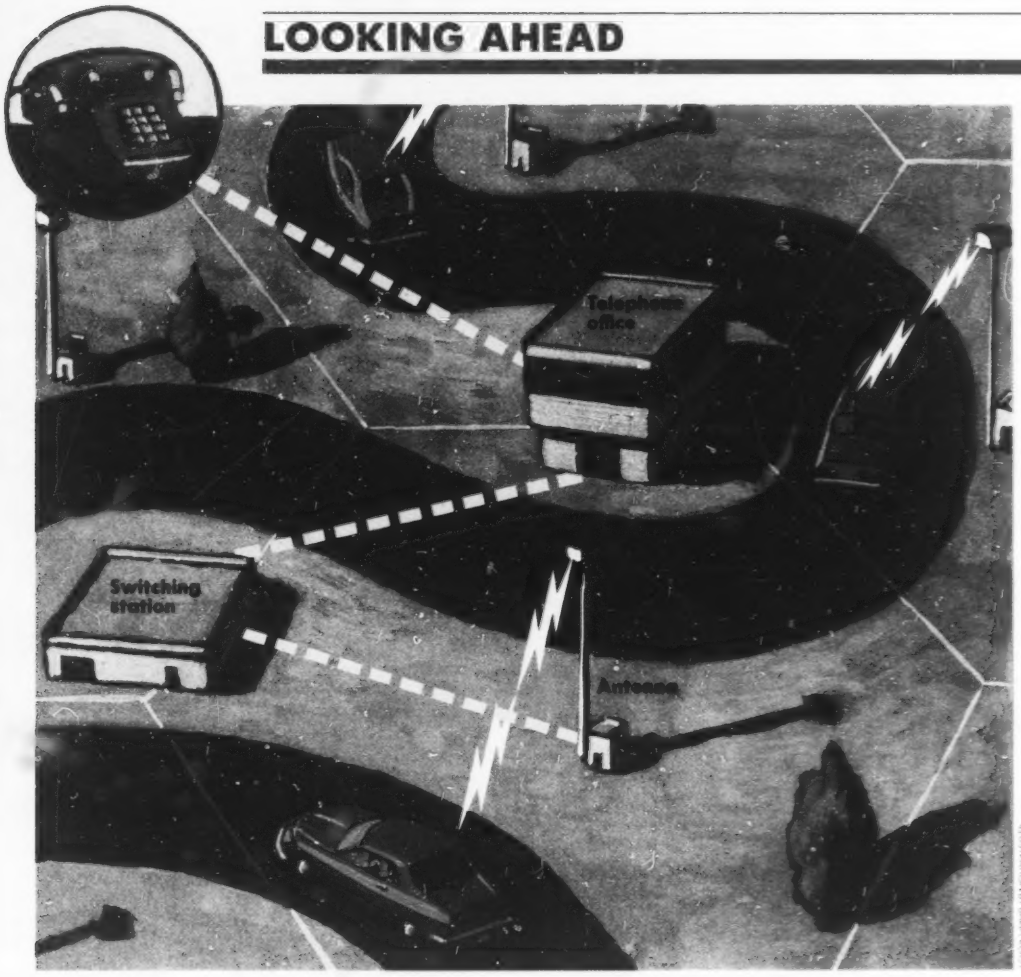


ILLUSTRATION BY DAVID SUTER

How It Works

Markets where cellular phone service is offered are divided into areas called cells. Each cell has its own antenna for receiving and transmitting signals. As cars move from one cell to another, computers at a central switching station transfer calls from one antenna to another. The calls are then patched into local phone systems like ordinary calls.

this market over the next 24 months does happen, half that price is possible." That would get equipment costs very close to his magic mass-market price. Roach goes on: "In the course of the next two years I'd hope to see monthly costs drop to $25 to $30." Such a decline should give demand a further healthy kick.

Advances in both equipment and service might also hoist consumer sales. Truly portable phones—models that could be toted around in purse or pocket for use on the hoof—might make cellular a rival of today's wired telephone systems. The only walk-around cellular phone now available, made by Motorola, costs more than $4,000. Its developer, Martin Cooper, head of Cellular Business Systems, a Chicago software company, believes portables will be available for as little as $1,000 within five years.

Many experts predict a hefty demand for additional over-the-telephone services. Mobile phones will be able to link up with computers to receive information on stock movements, inventory availability, sales orders, and other data. These services could be provided as hard copy, using printers or facsimile machines similar to those already used in various law-enforcement vehicles.

ANOTHER POSSIBLE cellular attraction: Oki is working on a burglar alarm that can be hooked up to a car phone. On parking a car, the driver records the location on tape and presets the number of the nearest precinct station. If somebody tries to break in, the car calls the cops. Oki expects to put the device on the market next year for about $500.

Cellular phone service will become available first in the top 90 markets, which contain about 74% of the U.S. population, but cellular may ultimately reach the potential customers who live and work in lesser markets, such as Battle Creek, Michigan. One scheme for spreading service into lightly settled rural areas and small towns and cities would link the cellular system with a direct broadcast satellite system instead of telephone lines. In King of Prussia, Pennsylvania, Roy E. Anderson, vice president and co-founder of Mobile Satellite Corp., a private company, says his company's plan to link cellular systems by satellite will cost "a few hundred million." But he has lined up several big investors, including Associated Communications and General Electric. He hopes to have the system working in 1988.

A cellular system works fairly simply: Each market area is divided into cells (hence the name cellular); a cell is an area that at present can measure up to 16 miles across, but can be divided. Someday, as demand builds, a cell may cover only a single office building. Each cell has an antenna capable of picking up and transmitting 666 calls simultaneously. Cellular transmitters use low power and frequencies that don't carry far, so channels can be used over and over.

As a car moves from one cell to another, computers linked with the transmitters transfer signals from one antenna to another as needed to keep them strong; the transfers take place unnoticeably, in fractions of seconds. By increasing the number of transmitters and reducing the size of cells, a cellular system could handle unlimited calls.

Mobile phones have been around for a couple of decades, but they've had a lot of disadvantages—mostly born of the limited number of radio channels assigned for this service. At the end of 1983 there were only 12 channels in New York City to be shared by 730 radio-phone subscribers, with a waiting list of at least 2,000. Even the lucky 730 often had long waits for a free circuit during rush hours. And quality was poor; callers sometimes sounded as if they were at the bottom of a well.

Those not familiar with the slow pace of life at the Federal Communications Commission might find it surprising that cellular technology is already a teenager. Bell Laboratories had developed a cellular system by 1971. After almost a decade of studies and hear-

ings and regulatory wranglings, the FCC finally authorized two trials, one in Chicago, the other in the Washington-Baltimore market. After four years of trials, Chicago's full-scale system started operating last October, Washington-Baltimore's in December. The FCC is speeding ahead with approval of still more systems, with Dallas, Detroit, and Milwaukee about ready to join the cellular club.

In authorizing cellular systems, the FCC imposed several important restrictions. First, it decided that each market should be limited to only two carriers—the local telephone company, or so-called wire line company, being one. The other carrier was to be a "nonwire" company, so named because many of these would-be carriers have backgrounds in wireless two-way radio or paging systems.

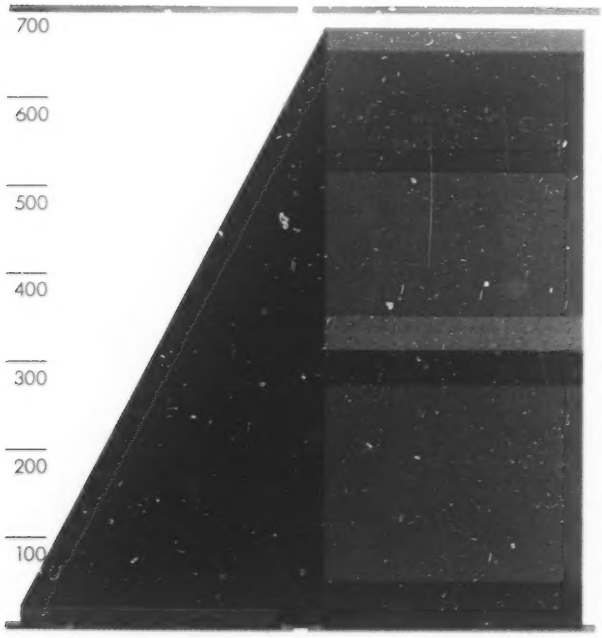
In setting aside half of each market for the telephone companies, the FCC reasoned that they are in a good position to get the cellular systems operating quickly and reliably. Other applicants oppose the set-aside rule on the ground that it gives the telephone companies an unfair competitive advantage; several nonwire companies have appealed to the FCC to drop the rule—which the FCC so far has repeatedly refused to do.

Nonwire carriers are unhappy that the phone companies enjoy what amounts to a monopoly on all business, because all cellular calls wind up on their wires. Jerry Taylor, president of mighty MCI's cellular subsidiary, which is applying for licenses in 12 of the top 30 markets, compares this to the monopoly AT&T once enjoyed throughout the U.S. phone system. "It's exactly the same thing," he says. "The phone companies would like to make cellular systems subservient to their central offices."

Taylor believes that cellular's future lies with truly portable phones. "That means that when you fly from New York to Washington, you'll be able to take your phone with you." Taylor also believes that all cellular phones will be interconnected through a national network—"a universe unto itself"—where cellular phones would share a single area code.

To increase competition, the FCC allows resale of cellular service. In New York, for example, where cellular currently is provided only by Nynex Mobile Communications, Western Union advertises its own cellular service. Western Union will install equipment made by its E.F. Johnson subsidiary in the customer's car, provide a telephone number, and do the billing. Though the actual service comes through Nynex, Western Union pushes the quality of its equipment and service.

RENT-A-CAR companies—Hertz, Avis, National, and Budget among others—are also resellers. They buy numbers from the phone company, install equipment in their cars, hook up meters that tick away as calls are made—local calls only, thank you, except with telephone credit cards—and then charge customers a premium for the privilege of driving a car with a cellular phone, as well as for calls actually made. In Indianapolis, Budget charges a premium of $7.50 a day, plus 50 cents



MARKET	COMPANY	POTENTIAL REVENUE 1990 in millions
Buffalo	NYNEX Buffalo Telephone	$ 46.2
Chicago	Ameritech Mobile Communications	$200.2
Indianapolis	Indianapolis Telephone GTE	$ 43.0
Los Angeles	PacTel Mobile Access	$293.4
Miami	BellSouth Mobility	$ 76.4
Minneapolis	NewVector Communications	$ 67.7
New York	NYNEX	$404.0
Washington/ Baltimore	Cellular One Bell Atlantic Mobile Systems	$150.0

The First Eight Cellular Systems and How They Might Grow

Cellular phones left the launch pad with a lot of lift. The eight markets in which cellular service was available in early July are expected to have over 40,000 subscribers by the end of 1984, as indicated by those long thin bars at the bottom left of the chart. By 1990 the number is expected to grow to nearly 700,000—enough to bring in telephone revenues, at present rates, of almost $1.3 billion a year. But that may be a modest estimate, based as it is on the probably faulty assumption that costs will stay as they are rather than fall. Industry experts think lower rates—and rising demand—are certain.

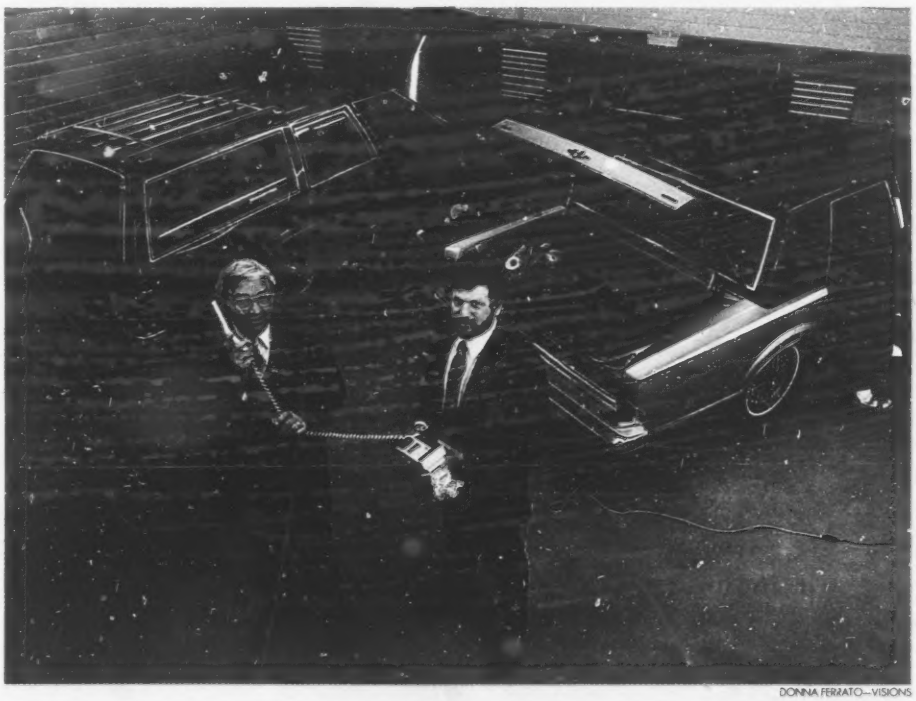
AN OPENING FOR ENTREPRENEURS

■ As the cellular telephone industry steams ahead, entrepreneurs are climbing aboard to sell, install, and service equipment. One with high hopes is Mark M. Mancini.

Mancini sold what stock he had and took out a second mortgage on his house. At the age of 51, having raised $250,000, he quit his job as vice president and general manager of Associated Communications, a New York City company that was seeking licenses to operate cellular telephone systems. In one of New York City's seedier neighborhoods he set up 800 Cellular (which, skipping the "r," also happens to be the phone number) to install and service mobile cellular phones. Mancini already has plans to open branches in Boston, Philadelphia, and Los Angeles, as well as other cities.

Lots of people share his optimism—in particular Mancini's 27-year-old banker, Paul E. Kelleman, assistant vice president of Midlantic National Bank's Secaucus, New Jersey, branch. Mancini says he had tried to raise money at all the financial giants in New York. "They either said no or they wanted to own you," he says. Kelleman recommended that Midlantic provide Mancini with an unsecured six-figure line of credit. Kelleman was impressed, he says, by Mancini's readiness to put up his house and by his 27 years of experience in radio communications.

Mancini and his sweat-equity partner, Lee M. Erdman, 34, a former special-effects whiz for Broadway and rock-and-roll shows, walked the West Side of Manhattan for months, looking for a site. They settled on a former Trailways bus garage right across the street from the New York Convention Center, scheduled for completion in 1986. By then, says Erdman, portable briefcase phones should be available: "We'll be renting them to people at the center." In June 800 Cellular opened for business and in early July was installing up to 20 phones a day, at $250 per installation. Mancini claims that cash flow is already positive.



DONNA FERRATO—VISIONS

At 800 Cellular *in New York City, workers install the transceiver for cellular telephone service in the trunk and the phone unit in the front of a Lincoln Town Car. Entrepreneur Mark Mancini (left) and his partner, Lee Erdman, turned an old bus garage into a bet on new technology.*

a minute for use of the phone. Other resellers include GM's Buick division and Ford's Lincoln-Mercury division, both of which offer mobile phones as optional extras on some models.

The resellers' rewards may be more than short term. LIN Cellular Communications, a subsidiary of New York's LIN Broadcasting Corp., an independent TV and radio company, is waiting for FCC permission to provide cellular service in Los Angeles. In the meantime, it is whiling away the time as a reseller for Pactel Mobile Access, a subsidiary of Pacific Telesis, parent of the former Bell operating companies in California and Nevada. LIN Cellular President Richard Verne points out that his company's contract with Pactel allows customers to take their phone numbers with them should they decide to switch from Pactel to LIN after LIN gets the nod to start service. That is an important concession. A customer who gets a mobile number is likely to print it on stationery and business cards. If the number can't be transferred, the customer is all but handcuffed to the cellular supplier that assigned it.

THE TELEPHONE companies got a head start in cellular by agreeing not to file competing applications to provide service in the top 30 markets (FORTUNE, July 12, 1982). They agreed that AT&T's seven operating companies would take 23 of these top markets, and General Telephone & Electronics seven. No such amity ruled among nontelephone companies wanting to get into cellular, and they lost precious time scrapping with one another for markets. Only recently have such companies as Metromedia, Western Union, Millicom, and Maxell Telecom Plus—all prominent in the rush for cellular—got together in what they call "the grand alliance." Under this alliance, encouraged by the FCC, only one partner will bid for a place in 55 of the next 60 cellular markets.

While the nonwire companies were still scrapping, the telephone companies rushed forth to snare what the industry calls "pent-ups"—customers so eager for mobile phones that they'll pay almost any price to get them. In New York, for example,

there were hundreds of them, many with phones installed weeks before the Nynex system was switched on in late June. When Nynex got approval, hundreds of early-bird customers began to line up. "This city's a zoo," exclaimed Bart Robins, manager of cellular installation at a Manhattan branch of Potamkin, a Cadillac and Toyota dealer. By the end of the first day after the switch-on, Robins was exasperated. "Everybody's got to be first. Me. Me. Me."

The carriers want to be first too. Nynex was subjected to a number of delays before it was allowed to switch on cellular service. When the FCC finally sent word to the company's Pearl River, New York, headquarters that it was okay to go ahead, one employee ran around the office shouting out the news "like Paul Revere," recalls Morgan J. Kennedy, Nynex Mobile's president. Then everybody went out and drank champagne.

Cellular One, a nonwire system, got a brief head start in the Washington-Baltimore market, where it competes with Bell Atlantic Mobile Systems, a subsidiary of Bell Atlantic. Wayne Schelle, chairman of Cellular One, figures being the early bird is worth "about two percentage points of market share a month." This calculation, he says, led to the formation of Cellular One, the first significant joint venture among competing nonwires.

When Schelle bid for the Washington license in 1982, the company he headed was named American Radio Telephone Service. ARTS, originally a beeper company, had operated a trial cellular service for four years. There were four other contenders: the Washington Post Co.; Metromedia; Metrocall, another paging company; and Metropolitan Radio Telephone Systen , a cellular consulting firm.

ARTS and the Post's cellular business merged, which cut the number of competitors by one. "We thought that the joint venture gave us a good combination, our experience and their big-league size and commitment to communications," says Schelle. But the FCC was moving slowly, ponderously mulling the applications of the three contenders. "I began to worry that the advantage we had, the four-year trial period, would be lost to a head start by Bell Atlantic."

So he began to think of some kind of further merger. In September, he sold the ARTS-Washington Post partnership to Metromedia for cash and part of the business. Cellular One was formed and won approval as the nonwire operator in the Washington-Baltimore market. The company's system began operating in December, four months ahead of Bell Atlantic. A marketing battle has ensued, but Schelle claims that the head start he gained has indeed paid off—Cellular One has 3,000 subscribers to an estimated 600 for Bell Atlantic.

Evan Richards *is a Chicago fan of cellular phones. He'd better be. As vice president of engineering and operations at Ameritech Mobile Communications, he is in charge of mobile phones for the Bell company that launched the first U.S. cellular system in October.*

MANUFACTURERS of cellular equipment also face a competitive struggle. Competition will be especially tough because there is little to differentiate products. Salesmanship makes the difference. Motorola, the dean of mobile telephony, lost a piece of business in its own backyard when Ericsson snatched the contract to build a switching station for Rogers Radiocall, a Metromedia subsidiary and Ameritech's Chicago competitor.

Oki sees itself as outstripping Motorola in the U.S. market. "We're No. 1," insists Mal Gurian, chairman and chief executive of Oki's U.S. operations. "We have more than a 50% market share." Motorola disputes the claim. But Oki is doing very well. The company has an exclusive agreement to provide New York's Nynex system with equipment, and another to provide 99% of Southwestern Bell's. It also has nonexclusive contracts with Bell Atlantic and Pactel. In fact, Oki's quick success nearly swamped it, and for a while the company was unable to keep pace with demand for its products. Now, Gurian says, Oki's first U.S. facility, a robot-filled factory in Norcross, Georgia, is in full production.

In fact, Oki may be supplying more customers than it wants to. A black market already seems to be flourishing in mobile phones. Gurian says he keeps seeing and hearing advertisements for Oki equipment "placed by people we've never heard of." The ads have shown up, he says, in New York, Miami, and Los Angeles. He adds: "It's driving me crazy trying to find out where they're getting the equipment." A product that spawns a black market clearly has good prospects. F